

is preferred that the major surface 42 of the body of the knurling wheel has an undercut 65. (Page 18, lines 2-3). Undercut 65 is illustrated as an arcuate surface extending around the full circumference of wheel 12. (Page 18, lines 3-4). The undercut provides an improved rake angle when the knurling wheel is engaged with the outer surface of the workpiece. (Page 18, lines 4-6). A positive rake angle provides more efficient cutting and reduces the amount of burring of the workpiece. (Page 18, lines 10-11). Neither the May nor Sloane references disclose an undercut feature. Therefore, they do not anticipate amended independent claim 37. Thus, claim 37 is allowable under 35 U.S.C. § 102. Because claims 38, 41, 42 and 45 depend either directly or indirectly from claim 37, they are likewise allowable. Applicant respectfully requests notice of the allowability of claims 37, 38, 41, 42 and 45 under 35 U.S.C. § 102.

Claim Rejections Under 35 U.S.C. Section 103

Claims 39, 40, 43 and 44 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sloane. These claims depend from independent amended claim 37, discussed above. Sloane does not teach or suggest a structure having an undercut portion on each of the first and second opposed major surfaces. Therefore, amended claim 37 is allowable under 35 U.S.C. § 103(a). Because claims 39, 40, 43 and 44 depend from claim 37, they are likewise allowable. Therefore, Applicant respectfully requests notice of the allowability of claims 39, 40, 43 and 44 under 35 U.S.C. § 103(a).

CONCLUSION

With the Amendment, Applicant has made an earnest effort to address all issues raised in the Office Action of October 2, 2002. In all revisions to the specification, drawings and claims proposed herein, no new matter is presented. Applicant respectfully requests approval of the proposed drawing revision, the proposed revisions to the specification and the revisions to claim 37. Applicant respectfully submits that these amendments place the application in condition for allowance, and a Notice of Allowance is respectfully requested.

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Application No.: 09/821,341

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**APPENDIX:
MARKED UP VERSION OF SPECIFICATION AND CLAIM AMENDMENTS**

IN THE SPECIFICATION

Paragraph at page 16, line 23 through page 17, line 10:

One embodiment of a cut knurling wheel tool 12 is illustrated in Figures 14 and 15. Knurling wheel 12 has a body which has along its outer working surface a plurality of teeth 44. Each tooth 44 includes a tooth ridge 48 and first and second side surfaces 52. A valley 50 bounded by one side surface 52 from each adjacent tooth 44 is located between each pair of adjacent teeth 44. The body of each wheel 12 also includes opposed major surfaces 42 (only one illustrated). Where the side surfaces 52 of the teeth 44 meet the major surface 42, an edge 46 is formed. For cut knurling, it is preferred that the major surface 42 of the knurling wheel has an undercut [55] 65. Undercut [55] 65 is illustrated as an arcuate surface extending around the full circumference of wheel 12. The undercut provides an improved rake angle when the knurling wheel is engaged with the outer surface of the workpiece. Alternatively, undercut [55] 65 can be flat or any other configuration to provide a zero or positive rake angle. The undercut [55] 65 preferably extends to ridge 48 in one direction, and extends far enough inward from ridge 48 to improve the cutting characteristics of edge 46 and major surface 42, preferably at least as far as tooth valley 50. A positive rake angle provides more efficient cutting than a zero or negative rake angle, and also reduces the amount of burring of the workpiece.

Paragraph at page 21, lines 7-18:

A preferred method of knurling a workpiece is illustrated in Figures 16 and 17, in which the tool holder 10 has been removed to more clearly illustrate the position of knurl wheel 12 with respect to the workpiece 30. Figures 16 and 17 are both top plan views of the workpiece [36] 30 and knurl wheel 12. A first plurality of grooves 38 having peaks 39 are initially cut. The tool holder 10 is set to orient the plane defined by knurl wheel axis C and knurl mount axis 20 at an obtuse angle θ . The tool holder is positioned such that axis A intersects and is perpendicular to the longitudinal axis 36 of the workpiece. The cutting knurl wheel 12 is engaged to a desired depth of cut into the workpiece surface 34 as the workpiece is rotated in the direction shown, and the knurl wheel is traversed in the direction shown. This first plurality of grooves 38 will have a first helix angle θ_1 , and the respective groove cross-sections will generally correspond to the shape of the valley 50 between teeth 44 on the knurl wheel.

Paragraph at page 26, lines 1-14:

A knurl tool holder 10, as described with respect to the preferred embodiment above, was installed on the cross slide of the lathe. Axis A of the tool holder 10 intersected with and was perpendicular to the longitudinal axis 36 of the workpiece. A knurl mount 14 having the axis

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C for the mounting wheel at an angle α of 85° was mounted on the second side 43 of the shaft 41. A dial indicator was used to set the plane defined by knurl wheel axis C and knurl mount axis 20 to vertical. The angle on vernier scale 59[, 60] at this orientation read $280^\circ 36'$. In the remaining description, this orientation will be deemed to be an angle θ of 90 degrees. If the tool holder 10 were adjusted to rotate the knurl mount 14 clockwise (as viewed from the rear side of the tool holder 10 facing the workpiece) by 90 degrees such that the plane defined by axis C and axis 20 is horizontal, the vernier would read $190^\circ 36'$. In the remaining discussion, such an orientation will be deemed to be [and] an angle θ of zero degrees. Positive angles are counterclockwise as viewed from the rear of the tool holder 10 looking toward the workpiece.

IN THE CLAIMS

37.(Twice Amended)A knurl wheel, comprising:

- a cylindrical body having a rotational axis and including first and second opposed major [radial] surfaces and an outer peripheral surface between said first and second major surfaces, each of the first and second surfaces having an undercut portion resulting in a positive rake angle; and
- a plurality of teeth on said outer peripheral surface, [each tooth being symmetrical in form along a radial extending from the axis,] said plurality of teeth including a first tooth and a second tooth, said second tooth being of substantially different configuration from said first tooth.

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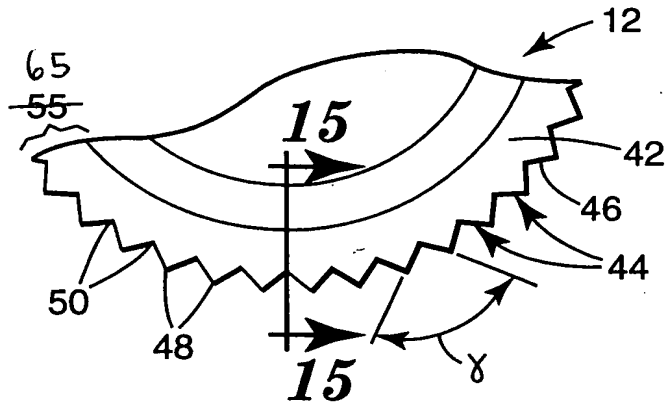


Fig. 14

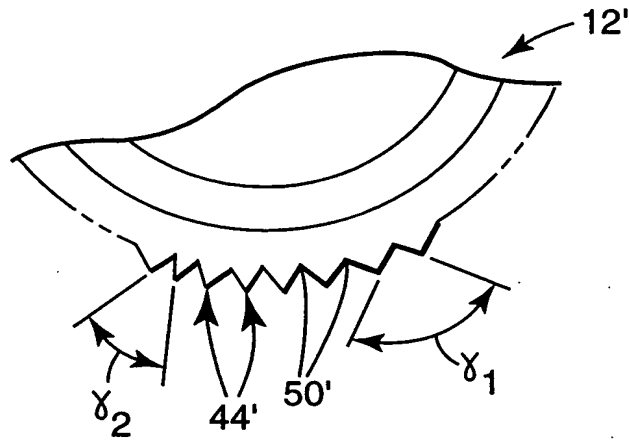


Fig. 14A

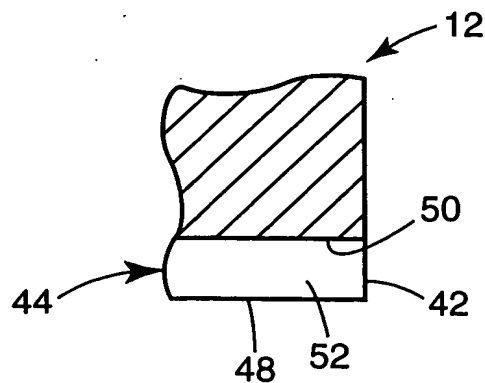


Fig. 15

Approved
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